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CONTENTS

Wesson—Contributions toward the Biology of Strumigenys pergandei: A New Food Relationship among Ants. (Hymen.: Formicidae). 171
Slifer—The Scoloparia of Melanoplus differentialis (Orthoptera Acrididae) 174
Michener—Some California Bees, Townsendiella and Hesperapis (Hymen.: Apoidea) 181
Hinton—Notes On Some American Colydiidae. (Coleoptera) 185
Rodeck—Colorado Lepidoptera Records (Pieridae. Sphingidae) 189
Mites Parasitic on Dragonflies Wanted 189
Entomological Literature 190
Review of Weiss' Pioneer Century of American Entomology 196
Review of Münchberg's Zur Kenntniss der Odonatenparasiten 197

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Contributions toward the Biology of Strumigenys pergandei : A New Food Relationship among Ants. (Hymen.: Formicidae).

By LAURENCE G. WESSON, JR., Haverford College, Penna.

Because of their small size, dull coloration, and hypogaeic habits the ants of the genus *Strumigenys* have been but little studied. Very little is known concerning them aside from the fact that they are sometimes found associated with other species of ants. This association has led some authors to assume that the *Strumigenys* are guests or thieves in the nests of other ants; but this does not explain many of the peculiarities of the genus such as their unusual pilosity, elongate mandibles, produced inner lobes of the maxillae and petiolar pads. In the present paper an apparently unique food relationship is described which, together with the morphological peculiarities, is explained directly by the basic biology of *Strumigenys*.

During the summer of 1935 I was able to find over 20 colonies of *S. pergandei* in the sandstone hills around Jackson, Ohio. These colonies were found under a wide range of conditions, but since eight were taken on a sandstone bluff only 30 yards long, and since most of the other colonies were found under similar conditions, this locality is described as typical. The soil consisted of two or three inches of pine duff on a shallow layer of clay resting on bed rock. The vegetation consisted of large patches of reindeer moss, *Cladonia rangiferina*, a few scattered weeds and grass tufts, and numerous small pines, *Pinus echinata*. The nature of the bed rock, and the insulating character of the moss assured constant moisture.

The *Strumigenys* were to be found by turning over the reindeer moss and carefully examining the pine needles beneath; but no colony was found which was not in, or in very close

proximity to, the nest of another larger ant. Specifically, one nest was found in a dead root in clay near a colony of *Lasius brevicornis;* another was found in clay in the midst of a nest of *Formica fusca subsericea* under a large flat rock; a third nest was found in the pine duff close to a colony of *Aphaenogaster fulva fulva;* a fourth was found in a small dead pine stump together with a colony of *Aphaenogaster fulva fulva.* All the other colonies were found very near nests of *A. fulva.*

In order to study *S. pergandei,* an artificial nest was constructed attempting to duplicate the natural conditions as nearly as possible. A modified Fielde nest was divided into three chambers such that a colony of *Strumigenys,* consisting of about 60 workers, lived in one chamber, a colony of *Aphaenogaster* lived in another chamber, and both species had access to the third, the forage chamber. The *Strumigenys* chamber was separated from the rest of the nest by a slit through which the little ants could pass but the *Aphaenogaster* could not. The *Strumigenys* were given clay and dead wood in which to excavate and the other two chambers were filled with dirt and pine needles.

From the beginning the *Strumigenys* showed no fear of the *Aphaenogaster,* but wandered freely among them. The *Aphaenogaster* were aware of their presence and smelled them cautiously, but on only a few occasions did they show any resentment: a worker would pick up a *Strumigenys.* which feigned death, then would carry her to the edge of the chamber and drop her; whereupon the little ant would uncurl unharmed and reenter the chamber. Over a period of ten months not a single *Strumigenys* was injured by an *Aphaenogaster.* The *Strumigenys* as a rule paid no attention to the other ants, but when an *Aphaenogaster* worker once broke into their nest they pulled fiercely at her legs.

At first the *Strumigenys* did not thrive. They occasionally nibbled at the food given to the *Aphaenogaster,* and drank some honey which had been spilled on the dirt. But their restlessness showed that they were not doing well. Then, on examining a wild colony, I captured a worker carrying in her mandibles a small white object, which, on closer examination was found to

be a springtail, *Podurid*. With this hint, I proceeded to examine more closely the wild colonies of *Aphaenogaster*, and found that in and around most of them were swarms of springtails. A great many springtails were then collected and introduced to the artificial nest. To my surprise and gratification, the *Strumigenys* captured over a dozen springtails in the nest in two hours. They appeared perfectly content thereafter as long as an ample supply of springtails was present, but when during the winter the supply became small, they showed their restlessness again, and began to devour their brood. I have not been able to make them take any other kind of small insect.

To hunt the springtails, the *Strumigenys* either lie in wait in some nook, or they explore in crannies and crevices in search of their prey. In either case the method of capture is the same. The moment the worker scents the springtail, which is one to four mm. away, depending on its size, she stops suddenly, slowly exploring with her antennae in its direction. Having waited for a few minutes, she moves by slow advances to within 1 mm. of it. Then she folds her antennae, lowers her head to the ground, and moves imperceptibly in the direction of the springtail until her mandibles almost touch it. She then waits until the springtail *moves* against her mandibles. When this happens, she strikes, seizing the springtail in her mandibles, piercing it with her sharp maxillary lobes; then drawing it back and stinging it. If, on the other hand, the springtail fails to move, she arouses it by vibrating her antennae around it. If the springtail moves away without touching her mandibles, she again repeats her approach. The source and species of the springtail make no apparent difference to the *Strumigenys*.

Concerning the nest life of *Strumigenys*, a number of interesting observations were made. The *Strumigenys* use their mandibles to excavate the nest, tend the brood and carry other workers to a new nesting site. The larvae are fed by being placed on top of whole springtails. The workers regurgitate to each other by approximating the under sides of their heads. The largest nest found contained 120 workers. All the nests consisted of a large irregular cavity, 2 to 10 cc. in volume, entered by a narrow tunnel.

The basic biology of *Strumigenys* may then be outlined. *Strumigenys pergandei* is an independent ant feeding almost exclusively on springtails. Springtails occur in large numbers in and around the nests of many species of ants. Consequently the *Strumigenys* gain access to these nests in order to reach their prey. Thus a loose form of symbiosis has developed, further evidenced by the nonhostile attitude of the host ant toward the *Strumigenys*. The *Strumigenys* are not restricted to any definite type of springtail, nesting site, or species of host ant. They may even be found living unassociated with any other species of ant in a locality naturally abounding in springtails. Almost all the morphological peculiarities noted are adaptations to this diet: the elongate mandibles and the produced maxillary lobes provide a suitable apparatus to capture and hold the slippery springtails; the extraordinary development of the pilosity on scape and funiculus probably indicates a corresponding development of the sense of smell. The small size of the *Strumigenys* colonies may be due to the fact that springtails do not usually occur in numbers sufficient to support a large colony; no instance was recorded where there was more than one colony in the same host nest. The petiolar pads and the large size of the nest cavity excavated by these little ants are also probably adaptations to this specialized diet.

The Scoloparia of Melanoplus differentialis (Orthoptera Acrididae).

By Eleanor H. Slifer, Department of Zoology, State University of Iowa, Iowa City.

Scolopale-bearing organs have been described not only from many parts of the insect body and its appendages but also from a great variety of insect species. In no one insect, however, have scoloparia been found in all locations in which they have been reported for insects in general. *Melanoplus differentialis*, the present account will show, does possess (with one possible exception) scoloparia in all those parts where they have been found in other species, as well as in several where none have been found before.

The scoloparia of the grasshopper are well formed before the young insect leaves the egg and since many of these struc-

tures are extremely small, even when fully developed, their location in the adult is made immeasureably easier by their location first in the advanced embryo. Eggs as well as adults, consequently, were used in the work to be reported here. Methods of fixing, sectioning and staining this material were described in an earlier paper (Slifer, 1935).

The exact number of scolopalia present in any organ is very difficult to determine. The numbers given in the following list should, therefore, be regarded as close approximations, which are of value, chiefly, to the reader who wishes to compare the relative sizes of different scoloparia. It should be noted, moreover, that the scolopale counts given are actually end-knob counts.

The scolopalia of the grasshopper exhibit great diversity. Some are large and conspicuous and possess well-developed basal and middle ring-zones; others are extremely minute and little detail, aside from the end-knob, can be distinguished in them; still others are intermediate in size and complexity of structure. Scolopalia of the first type may be seen in the tympanal organs; those of the second are present in many of the abdominal scoloparia; while representatives of the third type occur in the thorax. Not infrequently scolopalia of several different kinds may be found in a single scoloparium.

All of the scoloparia known to exist in *Melanoplus differentialis* are listed below. Those which have been reported in earlier papers, either for this or for other species of Acrididae, are so indicated. The reference given in each such case is one which contains a satisfactory description of the organ under consideration.

A LIST OF THE SCOLOPARIA OF MELANOPLUS DIFFERENTIALIS.

Head and its appendages.

Antenna—(1) 1st joint (scape), ventral. 8 scolopalia, distal to sensory cytons. Cyton ends of this and following scoloparium associated. (Eggers, 1924.)

(2) 1st joint, ventral to scoloparium described above. 4 scolopalia, distal to cytons. (Eggers, 1924.)

(3) 2nd joint (pedicel), Johnston's organ. 4 scolopalia, distal to cytons. (Eggers, 1924.)

(4) Tip. 1 scolopale, distal to cyton.

Maxilla—(5) 1st joint of palpus. 4 scolopalia, distal to cytons.

(6) Tip of palpus. 1 scolopale, distal to cyton.

(7) Base of lacinia. 4 scolopalia, distal to cytons. Cyton ends of this and following scoloparium associated.

(8) Base of lacinia. 2 scolopalia, distal and mesial to cytons.

Labium—(9) 2nd joint of palpus. 1 scolopale, distal to cyton.

(10) Tip of palpus. 1 scolopale, distal to cyton.

(11) Tip of paraglossa. 2 scolopalia, mesial to cytons.

Other parts of head—(12) Latero-ventral; anterior to cervicum. 6 scolopalia, anterior and lateral to cytons.

Thorax.

Prothorax—(13) Ventro-mesial; below anterior edge of ganglion and extending into prosternal spine. 15 scolopalia, ventral to cytons.

(14) Ventro-mesial; anterior to ganglion. 20 scolopalia, anterior and slightly mesial to cytons.

(15) Ventro-lateral; anterior to ganglion. 10 scolopalia, posterior to cytons.

(16) Ventro-mesial; posterior to ganglion and runs along inner edge of furca. 2 scolopalia, dorsal to cytons.

(17) Dorso-lateral; near posterior edge of prothorax. 26 scolopalia, posterior, dorsal and slightly mesial to cytons.

Mesothorax—(18) Ventro-mesial; lateral and anterior to ganglion. 15 scolopalia, ventral to cytons.

(19) Ventro-mesial; lateral to ganglion. 6 scolopalia, posterior and slightly lateral to cytons. Cyton ends of this and two following scoloparia associated.

(20) Ventro-mesial; lateral to ganglion. 10 scolopalia, posterior and distinctly lateral to cytons.

(21) Ventro-mesial; lateral to ganglion. 19 scolopalia, anterior and slightly mesial to cytons.

(22) Ventro-mesial; posterior to ganglion and runs along inner edge of furca. 3 scolopalia, dorsal to cytons.

(23) Ventro-lateral; attached to membrane anterior to leg. 12 scolopalia, dorsal to cytons.

(24) Dorso-lateral; near posterior border of mesothorax. Extends into base of tegmen. 12 scolopalia, lateral and slightly dorsal to cytons.

Metathorax—(25) Ventro-mesial; lateral to anterior edge of ganglion. 23 scolopalia, anterior and slightly mesial to cytons.

(26) Ventro-mesial; lateral to middle of ganglion. 24 scolopalia, posterior and mesial to cytons.

(27) Ventro-mesial; lateral to posterior portions of ganglion. 17 scolopalia, posterior and lateral to cytons.

(28) Ventro-mesial; lateral to posterior end of ganglion and mesial to furca. 8 scolopalia, posterior to cytons.

(29) Ventro-lateral; attached to membrane anterior to leg. 17 scolopalia, anterior to cytons.

(30) Dorso-lateral; near posterior border of metathorax. Extends into base of wing. 12 scolopalia, posterior and slightly lateral to cytons.

Abdomen.

Segment 1—(31) Tympanal organ. 95 scolopalia. (Schwabe, 1906.)

(32) Lateral; near membrane of leg. 2 scolopalia, dorsal and anterior to cytons.

Segment 2—(33) Ventro-lateral; posterior to spiracle. 5 scolopalia, posterior and lateral to cytons.

(34) Ventro-lateral; mesial to scoloparium described above. 2 scolopalia, posterior and slightly mesial to cytons.

(35) Ventro-mesial; ventral and lateral to connectives between metathoracic and 1st abdominal ganglia. 3 scolopalia, anterior to cytons.

Segment 3—(36) Ventro-lateral; posterior to spiracle. 4 scolopalia, posterior and lateral to cytons.

(37) Ventro-lateral; mesial to scoloparium described above. 1 scolopale, posterior and slightly mesial to cyton.

(38) Ventro-mesial; lateral to 1st abdominal ganglion. 5 scolopalia, anterior to cytons.

Segment 4—(39) Ventro-lateral; posterior to spiracle. 5 scolopalia, posterior and lateral to cytons.

(40) Ventro-lateral; mesial to scoloparium described above. 3 scolopalia, posterior and slightly mesial to cytons.

(41) Ventro-mesial; anterior to 2nd abdominal ganglion. 1 scolopale, anterior to cyton.

Segment 5—(42) Ventro-lateral; posterior to spiracle. 5 scolopalia, posterior and lateral to cytons.

(43) Ventro-lateral; mesial to scoloparium described above. 1 scolopale, posterior and slightly mesial to cyton.

(44) Ventro-mesial; lateral to connectives between 2nd and 3rd abdominal ganglia. 2 scolopalia, anterior and slightly mesial to cytons.

Segment 6—(45) Ventro-lateral; posterior to spiracle. 6 scolopalia, posterior and lateral to cytons.

(46) Ventro-lateral; mesial to scoloparium described above. 3 scolopalia, posterior and slightly mesial to cytons.

(47) Ventro-mesial; lateral and slightly anterior to 3rd abdominal ganglion. 2 scolopalia, anterior and slightly lateral to cytons.

Segment 7—(48) Ventro-lateral; posterior to spiracle. 6 scolopalia, posterior and lateral to cytons.

(49) Ventro-lateral; mesial to scoloparium described above. 1 scolopale, posterior and slightly mesial to cyton.

(50) Ventro-mesial; lateral and anterior to 4th abdominal ganglion. 3 scolopalia, anterior to cytons.

Segment 8—(51) Ventro-lateral; posterior to spiracle. 4 scolopalia, posterior and slightly lateral to cytons.

(52) Ventro-lateral; mesial to scoloparium described above. 3 scolopalia, posterior and slightly lateral to cytons.

(53) Ventro-mesial; lateral and anterior to 5th abdominal ganglion. 4 scolopalia, anterior and slightly lateral to cytons.

Segment 9—(54) Ventro-lateral. 6 scolopalia, dorsal to cytons

Segment 11—(55) Posterior tip of both ♂ and ♀ cercus, outer surface. 2 scolopalia, dorsal to cytons.

Prothoracic leg.

Femur—(56) Anterior, proximal surface. 310 scolopalia, distal to cytons. (Slifer, 1935.)

(57) Mesial and distal to scoloparium described above. 28 scolopalia, distal to cytons. (Slifer, 1935.)

Tibia—(58) Subgenual organ. Anterior, proximal surface. 15 scolopalia, distal and mesial to cytons. (Friedrich, 1929.)

(59) Distal organ. Distal to scoloparium described above. 7 scolopalia, distal to cytons. (Friedrich, 1929.)

(60) Distal end of tibia. 7 scolopalia, distal to cytons.

Tarsus—(61) 5th tarsomere, distal. 2 scolopalia, distal to cytons.

(62) 5th tarsomere, extreme distal end. 2 scolopalia, distal to cytons.

Mesothoracic leg.

Femur—(63) Anterior, proximal surface. 330 scolopalia, distal to cytons. (Slifer, 1935.)

(64) Mesial and distal to scoloparium described above. 35 scolopalia, distal to cytons. (Slifer, 1935.)

Tibia—(65) Subgenual organ. Anterior proximal surface. 18 scolopalia, distal and mesial to cytons. (Friedrich, 1929.)

(66) Distal organ. Distal to scoloparium described above. 13 scolopalia, distal to cytons. (Friedrich, 1929.)

(67) Distal end of tibia. 8 scolopalia, distal to cytons.

Tarsus—(68) 5th tarsomere, distal. 2 scolopalia, distal to cytons.

(69) 5th tarsomere, extreme distal end. 2 scolopalia, distal to cytons.

Metathoracic leg.

Femur—(70) Anterior, distal surface. 55 scolopalia, distal to cytons. (Slifer, 1935.)

Tibia—(71) Subgenual organ. Anterior proximal surface. 10 scolopalia, distal and mesial to cytons. (Friedrich, 1929.)

(72) Distal organ. Distal to scoloparium described above. 6 scolopalia, distal to cytons. (Friedrich, 1929.)

(73) Distal end of tibia. 3 scolopalia, distal to cytons.

Tarsus—(74) 5th tarsomere, distal end. 3 scolopalia, distal to cytons.

(75) 5th tarsomere, extreme distal end. 2 scolopalia, distal to cytons.

Metathoracic wing.

(76) Base. 1 scolopale, distal to cyton.[1]

Summary.

(1) *Melanoplus differentialis*, besides the ten pairs of scoloparia found by earlier workers in other species of Acrididae and the five femoral pairs reported for this species by the present author, possesses sixty-one pairs of scoloparia which are described here for the first time.

(2) Scoloparia have been found in *Melanoplus differentialis* in every part of the body (with the exception of the tegmina) in which they have been found in other insects and, in addition, in some locations where none have previously been reported in any insect.

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[1] Erhardt (1916) searched the mesothoracic and metathoracic wing-bases of Pachytylus nigrofasciatus and Psophus stridulus for chordotonal organs but found none.

Some California Bees, Townsendiella and Hesperapis (Hymen.: Apoidea).

By CHARLES D. MICHENER, Pasadena, California.

Until now only one species of *Townsendiella* has been known. An additional species, therefore, is of unusual interest, especially when it is found to be perhaps generically distinct from the type *T. pulchra* Cwfd., from New Mexico. The present species does not have flattened claws. The proportions of the joints of the palpi are different from those given by Crawford, the venation is somewhat different, and the general appearance is that of a black, finely punctured *Holcopasites,* rather than of a *Neolarra* as stated by Crawford for *T. pulchra.* The types of the new species are in the author's collection.

Townsendiella californica n. sp.

♀ : Length 4½ to a little over 5 mm.; black, the clypeus, labrum, mandibles except apices, and sides of first two tergites pale red; head about round viewed from in front; entire body covered with very short dense pubescence except a large triangular area on propodeum which is dull and very finely roughened; pubescence of sides of face, cheeks, longitudinal band through median ocellus, pleura, propodeum, most of scutellum, lateral edges and a pair of longitudinal discal lines on scutum, white; rest of pubescence on head and thorax pale brown; posterior outer edge of tegulae bare and shiny; femora and to a lesser extent the tibiae somewhat reddish; outer faces of hind and middle tibiae with a number of small spines; pubescence of abdomen nearly white, the following markings nearly black: transverse band with a median apical lobe on first tergite; similar but broader bands on second and third tergites, these extending to the anterior margins of the tergites, and the lobes extending to the posterior margins, the ends of the bands bent posteriorly; three spots on posterior half of fourth tergite, these faintly connected anteriorly. Posterior margin of fifth tergite bare, shiny, with a few small punctures; pygidial area parallel sided, broadly rounded posteriorly, bare, with abundant coarse punctures; wings short, the apical margin broadly dusky, the veins and stigma black, the first recurrent vein meeting or basad to first transverse cubital, the second recurrent vein half way from base to apex of second submarginal cell, the latter narrowed almost to a point above, the marginal cell rounded at apex, with a small appendage; maxillary palpi six jointed,

the second joint longest, the first, third, and fourth of about equal length and shortest, the fifth and sixth of about equal length; labial palpi four jointed, the second joint about two thirds as long as first, the third and fourth of about equal length, together a little less than two thirds as long as second; tongue a little shorter than labial palpi; under side of flagellum dull brownish, the scape about as long as next three joints together; mandibles simple; labrum broader than long.

One individual has the pubescence rather worn, so that the sculpturing of head and thorax can be seen. Wherever visible the surface is only faintly shining, with numerous close minute punctures (except as described above for propodeum).

♂. Similar to female but clypeus appearing blackish, its lateral margins reflexed; tegulae reddish; legs blacker; pubescence usually paler; pygidial area more slender, its sides converging posteriorly.

Holotype, a female, and paratypes, Altadena, CALIFORNIA, June 24 and 26, 1935, flying close over the ground in a colony of *Hesperapis rufipes* (Ashm.) where they were doubtless parasitic (Michener).

HESPERAPIS RUFIPES (Ashmead).

♂. Length 4 to 5½ mm.; form robust, the flagellum short as in a female; black, the anterior edge of clypeus broadly dull yellow, the labrum, mandibles except apices, and malar space also dull yellow; flagellum ferruginous, paler beneath; legs except for the coxae red, the anterior femora infuscated with black above; tegulae rather dark testaceous; eyes converging below; facial line longer than transfacial; head and thorax rather shiny, hardly sculptured, though the clypeus has a few punctures; enclosure of propodeum shining; anterior edge of clypeus depressed; head and thorax largely covered with short hair, that on top of head and thorax rather moss-like, dense, fulvous to pale ochraceous, that on cheeks and sides of thorax paler, sometimes white; abdomen only slightly shining, the tergites with apical bands of ochraceous to white pubescence, the apices of the tergites beneath the bands translucent whitish; pygidial area reddish; wings slightly dusky, the veins and stigma black.

♀. Length 6 to 7 mm.; black, the anterior margin of clypeus broadly dull red; mandibles except for the blackish apices, labrum, and malar space also dull red; legs black; venter of abdomen red; tergites one to three red, two and three black at extreme sides; tergite four black, faintly red at base; remaining

tergites black, the base of pygidial area red; flagellum red, paler beneath; sculpture and structure similar to that described for male; pygidial area with a longitudinal median groove in apical part; abdomen with bands of white pubescence similar to those of male; pubescence of head and thorax sparser than in the male, white except for dorsum of head and thorax where it is ochraceous and moss-like; vertex with some black hairs.

Many specimens from Altadena, CALIFORNIA, June 11, 1933, May 12, 1934, and June 26 and 28, 1935 (Michener). They were flying over the ground within two small areas about half a mile apart. Here they were very abundant, nesting in the hard flat ground and visiting flowers, chiefly those of *Hugelia virgata*. Outside of these areas none could be found, although the *Hugelia* and other vegetation appeared just the same and the ground looked the same.

The nearest relative is *H. elegantula*, (Ckll.), which has paler wings and stigma. Mr. P. H. Timberlake first identified my specimens as *H. rufipes*. In his very extensive collecting at Riverside, he has never taken it.

Hesperapis arida n. sp.

♂. Length 6 to 7 mm.; form robust, the abdomen flattened, and the antennae short, much like the female; flagellum ferruginous beneath; eyes strongly converging below; mandibles red, the bases black, the apices blackish; clypeus somewhat shining with fine punctures; rest of head and thorax about the same, the enclosure of propodeum entirely dull; tegulae testaceous; wings clear, the veins nearly black, the stigma rather dark brown, shorter than in *H. wilmattae* Ckll.; abdomen absolutely dull, except for base of first tergite, which has a very faint shininess; tergites with broad white apical bands, the tegument beneath them testaceous; pygidial area red; legs black, the tibial spurs, hind knee plate, and extreme apices of tibiae reddish; pubescence mostly white, short, longest on lower part of cheeks, abundant on face, cheeks, pleura, sides of propodeum, and legs, that on under side of metatarsi ferruginous; sides of tergites with considerable hair between the bands; scutum with short, dull ochraceous, moss-like hair, and some longer white hairs.

♀. Length 8 mm.; similar to the male; anterior margin of clypeus dark red; moss-like hair of scutum more copious; pygidial area hardly red; entire first tergite with a very faint shininess; hind tibiae and tarsi with some rather long black hair.

Holotype, a male, and numerous paratypes from 20 miles south of Twenty Nine Palms, San Bernardino County, CALIFORNIA, April 14, 1935, on *Larrea tridentata* var. *glutinosa* (Michener, Coll.) The male is very distinct from *H. wilmattae* Ckll. by the short antennae, robust form, etc. The females, however, are not easily separated. The following characters are useful in their separation:

wilmattae.	*arida.*
Anterior margin of clypeus black.	Anterior margin of clypeus dark red.
Abdomen faintly shiny.	Abdomen beyond second tergite very dull.
Hind tibiae with few black hairs.	Hind tibiae with many black hairs.
Labrum black.	Labrum dark red.
Apices of mandibles red.	Apices of mandibles black.

Hesperapis leucura Ckll. is somewhat similar but smaller and more shiny.

HESPERAPIS WILMATTAE Cockerell.

♂. Similar to female, the antennae black; abdomen a little more shining; hind legs without black hairs; pubescence rather long, white, entirely covering face, and abundant on thorax, there being no moss-like hair on scutum.

Dry Lake (east of Borego Valley) (T. D. A. & W. P. Cockerell); Cottonwood Springs, Riverside County, April 14, 1935 (Michener), all in California.

The male is close to *H. nitidula* Ckll. but larger, eyes gray (green in *nitidula*); face narrower; posterior part of enclosure of propodeum duller (strongly shining, though not smooth in *nitidula*); genitalia nearly black in *wilmattae,* brown in *nitidula.*

Hesperapis may be divided into two subgenera, as follows:

Male robust, with the form of a female, the flagellum short, its joints broader than long; moss-like pubescence present on dorsum ..... *Hesperapis* s. str.

Male slender, the flagellum long, most of the joints longer

than broad; moss-like pubescence absent except in female *H. wilmattae* ..... *Panurgomia* Vier.

Zacesta Ashm. is a synonym of *Hesperapis* s. str.

Hesperapis s. str. includes *elegantula* Ckll., *rufipes* (Ashm.), and *arida* Mich. Although male *elegantula* is unknown, I think that there is no doubt of its relation to *rufipes*.

Panurgomia includes all the American species which I have seen except those mentioned above.

Notes On Some American Colydiidae. (Coleoptera).

By Howard Everest Hinton, Zoological Laboratory, Cambridge, England.

This paper, one of the last of a series, is a result of the study of a few remaining species of neotropical Colydiidae represented in the various collections before the writer from the United States National Museum and Mr. F. Nevermann. One genus is here relegated to synonomy, two new species are described, one species is removed from one genus and placed in another, and notes and additional locality records are given for five other species.

The writer takes this opportunity of expressing his thanks to Dr. K. G. Blair of the British Museum (Natural History) and Dr. A. D. Imms of Cambridge University for their generous assistance in the preparation of this and other papers of the series.

Lapethini.

Lapethus Casey

1890. *Lapethus* Casey, Ann. N. York. Acad. V, p. 317, 321.
1895. *Lapethus* Sharp, Biol. Centr.-Amer. Col. II, 1, p. 494.
1895. *Lytopeplus* Sharp, Biol. Centr.-Amer. Col. II, 1, p. 494.
1898. *Brachylon* Gorh. Biol. Centr.-Amer. Col. VII, p. 256.
1913. *Lytopeplus* Champion, Trans. Ent. Soc. London, p. 79.

The only character separating *Lapethus* Casey from *Lytopeplus* Sharp is the greater separation of the front and middle coxae in the latter, but as this difference is only a matter of degree and is bridged by certain species (*Lapethus sharpi* Champ, etc.), it seems undesirable to retain the genus *Lytopeplus* Sharp.

LAPETHUS BREVIS (Gorh.) (1898)

One, Guatemala: Alta V. Paz, Cacao, Trece Aguas, IV-19-1906 (*Barber, Schwarz*). This specimen is about one-third smaller than the smallest specimen in the series in the British Museum, but is otherwise similar.

LAPETHUS SHARPI (Champ.) (1913)

Two, as follows: One, Guatemala: Alta V. Paz, Cacao, Trece Aguas, IV-24-1906 (*Barber, Schwarz*). One, Mexico: Estado de Morelos, Cuernavaca, VI-1934 (*H. E. Hinton*).

LAPETHUS SULCIMARGO (Champ.) (1913)

One, Guatemala: Jacala, V-2-1906 (*Barber, Schwarz*). This specimen is slightly smaller and more evidently punctate than the unique type from Chontales, Nicaragua, but otherwise it seems to agree rather well. However, when a longer series is found, it may prove to be new.

LAPETHUS ALLUAUDI (Grouv.) (1894)

1894. *Mychocerus alluaudi* Grouv. Ann. Soc. Ent. Fr. LXIII, p. 15.

1918. *Mychocerus alluaudi* Grouv. Trans. Ent. Soc. London, p. 45, 47.

While studying the genus *Lapethus* and related genera, the writer had occasion to examine this non-American species. Typical examples collected in the Seychelle Islands agree in all important particulars with the genus *Lapethus* Casey, this genus differing from *Mychocerus* Er. in the position of the antennal cavities and in the absence of prosternal striae.

Lapethus cubanus sp. n.

Moderately narrowly obovate (length to breadth ratio about 115 : 68), moderately strongly convex. Cuticle shining, rufo-piceous; antennae, mouth-parts and legs rufo-testaceous.

Head finely punctate with punctures which are separated mostly by two to three times their diameters. Maxillary and labial palpi with the terminal segment in the form of a stout spine.

Prothorax at broadest point (base) one-third broader than long (60 : 42) and apical margin between apical angles much narrower than base (30 : 60). Apical margin extremely finely, scarcely noticeably margined; sides finely completely margined, when viewed from above converging moderately towards apex in basal one-half and more strongly so in apical one-half, when

viewed laterally the lateral margin is moderately strongly arcuate in apical one-half and straight but feebly oblique in basal one-half; base extremely finely but completely margined, moderately strongly sinuate on each side. Pronotum without an accessory lateral stria; surface with the punctures moderately fine, about twice as coarse as those of head and separated mostly by one to two times their diameters though often sparser.

Elytra nearly twice as long as prothorax (76 : 42) and broadest at about apical one-half. Surface apparently feebly striate (actually without strial lines), punctures corresponding to strial punctures coarse, subovate to nearly round and separated longitudinally on disk by one to two times their diameters; intervals flat, apparently impunctate.

Beneath with the surface of the prosternum microscopically alutaceous and obscurely punctate with punctures which are about as coarse or slightly coarser and as sparse as those of pronotum. Metasternum without a median impressed line on disk; surface of disk only extremely finely and sparsely punctate; lateral stria clearly marked. First ventral abdominal segment with the lateral stria extending near lateral margin of segment. Length, 1.4 mm.; breadth, .9 mm.

Type: In the collection of the United States National Museum. Greater Antilles: CUBA, Cayamas (*E. A. Schwarz*).

The new species differs from *L. substriatus* (Champ.) in its less depressed form and less strongly bisinuate prothoracic base. *L. cubanus* Hntn. is rather close to *L. ferrugineus* (Hntn. and Anc.) (1934) but is less ovate and more oblong and has the prothoracic base extremely finely margined near the middle, whereas in *ferrugineus* the base is not margined. Also, in the new species the lateral margin when viewed laterally is more strongly arcuate in apical one-half than it is in *ferrugineus*.

Lapethus lateralis sp. n.

Obovate, moderately convex; cuticle alutaceous for the most part, shining, rufo-piceous; antennae, mouth-parts and legs somewhat rufo-testaceous.

Head finely punctate with punctures which are separated mostly by one to two times their diameters. Maxillary and labial palpi with the terminal segment in the form of a stout spine.

Prothorax at broadest point (base) one-third broader than long (62 : 40) and apical margin between apical angles much narrower than base (29 : 62). Apical margin extremely finely,

scarcely noticeably margined; sides finely and completely margined, when viewed dorsally converging slightly towards apex in basal one-half and more strongly so in apical one-half, when viewed laterally the lateral margin is strongly arcuate in apical one-half and straight but feebly oblique in basal one-half; base extremely finely and completely margined, moderately sinuate on each side. Pronotum without an accessory lateral stria; surface with the punctures about or slightly coarser than those of head and separated mostly by one to two times their diameters.

Elytra nearly twice as long as prothorax (75 : 40) and broadest at about apical one-half. Surface apparently feebly striate (appearance due to arrangement of punctures), punctures corresponding to strial punctures rather coarse and irregularly separated on disk but usually separated by two or more times their diameters; intervals flat, finely and sparsely punctate, but apparently impunctate.

Beneath with the surface of the prosternum at middle only finely and sparsely punctate. Disk of metasternum without a median impressed line; surface of disk extremely finely punctate with punctures which are separated mostly by five or more times their diameters; lateral stria well defined. First ventral abdominal segment with the lateral stria becoming obsolete at posterior one seventh of segment and only slightly extended laterally near end, not clearly marked beyond basal two-thirds. Length, 1.4 mm.; breadth, .9 mm.

Type: In the collection of the United States National Museum. On log from BRAZIL, IV-24-1934 (*J. H. Moreland*).

From *L. brazilianus* Champ. (1913), the new species differs in its smaller size and in not having the elytral intervals "rather convex and closely, minutely punctulate." From *L. substriatus* (Champ.) (1913), it differs in having the base of the prothorax feebly instead of strongly bisinuate, and from *L. ferrugineus* (Hntn. & Anc.), it may be separated by its less oval form and margined prothoracic base. It is, however, apparently most closely related to *L. cubanus* Hntn. and is separated from this West Indian species only with some difficulty, and, indeed, it is possible that a long series will show these two to be the same. The new species has the apical half of the lateral margin of the prothorax (when viewed laterally) distinctly more strongly arcuate than *cubanus,* and has the lateral stria on the first ventral abdominal segment much less clearly marked and not extending laterally for so great a distance.

CERYLONINI.

TYRTAEUS RUFUS Champ. (1913)

One, Panama: Paraiso, III-4-1911 (*E. A. Schwarz*). This specimen is distinctly smaller than any in the series in the British Museum, and in addition it has the elytra slightly more coarsely punctate.

PHILOTHERMUS PUBERULUS Schwarz (1878)

Five, as follows: Two, Mexico: Tampico, XII-27 (*E. A. Schwarz*). One, Guatemala: Jacala, V-2-1906 (*Barber, Schwarz*). One, Guatemala: Alta V. Paz, Cacao, Trece Aguas, IV-28-1906 (*Barber, Schwarz*). One, Panama: Paraiso, I-30-1911 (*E. A. Schwarz*).

Colorado Lepidoptera Records (Pieridae. Sphingidae).

A badly rubbed specimen of *Gonepteryx clorinde* (Godart) (Rhopalocera: Pieridae) was collected in Denver, Colorado, on July 15, 1935, at flowers of *Delphinium* by Mrs. Minnie Gibbons. Holland (Moth Book, 1931) records it as—"Very abundant in Mexico, but only occurs as a straggler in the extreme southwestern part of Texas." The specimen has an expanse of 3⅜ inches as compared with Holland's figure of 4 to 5 inches.

At Albion Lake in western Boulder County, Colorado, a specimen of *Celerio lineata* Fabricius (Heterocera: Sphingidae) was collected at flowers of the Blue Columbine, *Aquilegia caerulea*, on July 25, 1935. This locality is at an altitude of 11,000 feet and is very close to the crest of the Continental Divide.—HUGO G. RODECK, University of Colorado Museum, Boulder, Colorado.

Mites Parasitic on Dragonflies Wanted.

Dr. Paul Münchberg, Bahnhofstr. 16, Schloppe, Kreis Dt. Krone, Grenzmark, Germany, whose work on mite larvae parasitic on Odonata is noticed on page 197 *postcà*, asks for *living* American material, especially from *Lestes* and *Sympetrum*. Remove mites, not smaller than .6 mm., with a needle, place in loose damp cotton wool in a vial closed with plug of same, wrap with paraffin paper and mail in tube or box to him.

Entomological Literature

COMPILED BY V. S. L. PATE, LAURA S. MACKEY and E. T. CRESSON, JR.

Under the above head it is intended to note papers received at the Academy of Natural Sciences, of Philadelphia, pertaining to the Entomology of the Americas (North and South), including Arachnida and Myriopoda. Articles irrelevant to American entomology will not be noted; but contributions to anatomy, physiology and embryology of insects, however, whether relating to American or exotic species will be recorded.

The **figures within brackets** [ ] refer to the journal in which the paper appeared, as numbered in the list of Periodicals and Serials published in our January and June issues. This list may be secured from the publisher of ENTOMOLOGICAL NEWS for 10c. The number of, or annual **volume**, and in some cases the part, heft, &c. the latter **within** ( ) follows; then the pagination follows the **colon** :

All continued papers, with few exceptions, are recorded only at their first installments.

(*) Papers containing new forms or names not so stated in titles, have an * within parentheses thus (*) following the pagination of reference to paper.

(S) Papers pertaining exclusively to neotropical species, and not so indicated in the title, have the symbol (S) at the end of the title of the paper.

For records of Economic Literature, see the Experiment Station Record, Office of Experiment Stations, Washington. Also Review of Applied Entomology, Series A, London. For records of papers on Medical Entomology, see Review of Applied Entomology, Series B.

Note. Titles of papers containing new forms or new names will be indicated by an asterisk within parentheses at end of reference, (*).

Papers published in the Entomological News are not listed.

New Titles of Periodicals and Serials Referred to

14. Archivos do Instituto Biologico, Sao Paulo.

GENERAL.—Anon.—Une invention remarquable due à l'entomologie "Le procédé Heliophore." [Lambillionea] 36: 90-93, ill. **Brossard, R.**—La photographie stereoscopique en couleurs des papillons et des chenilles. [L'Amat. Papillons] 8: 25-34. **Browne, C. A.**—Some relations of the New Harmony movement to the history of science in America. [Sc. Month.] 1936: 483-497, ill. **Carter, W.**—Insects and Plant Diseases. [37] 9: 159-170, ill. **Chagnon, G.**—Insectes nouveaux ou peu connus captures dans la tourbiere de Lanoraie, Quebec. [98] 63: 164-166. **Cockerell, T. D. A.**—The entomology of Prince Albert National Park, Saskatchewan. [4] 68: 85-88. **Curran, C. H.**—How insects protect their eggs. [Nat. Hist. N. Y.] 37: 441-456, ill. **Drake, C. J.**—Teaching and training in the field of entomology. [12] 29: 28-36. **Gibson, A.**—Recent advances in applied entomology in Canada. [V. Cong. Intern. Ent., Paris] 1932: 45-63. **Guignot, F.**—Sur les types en entomologie. [Misc. Ent.] 37: 28-30. **Hacker, H.**—An Introduction to Beekeeping. [Queensland (Austral.) Dept. Agr. & Stock, Div. Ent. & Pl. Path.] Bull. 11 (N. S.), 46 pp., ill. **Hardy, G. A.**—Notes on Vancouver Island Cerambycidae. [Rept. Prov. Mus. Nat. Hist. Brit. Col.] 1935: 34-35. **Hinds, W. E.**—Obituary. By F. L. Thomas. [12] 29: 225-226. **Linsley & Usinger.**—Insect collecting in California—II. Foothill region. [55] 12: 48-55, ill. **Maneval, H.**—Insectes fossiles des

calcaires Oligocenes de Ronzon. [Mem. Soc. Linn. Lyon] 79: 22-37, ill. (*). **Sanders, J. G.**—The commercial entomologist. [12] 29: 20-28. **Schmiedeknecht, O.**—Obituary by H. Hedicke. [Mit. Deutsch. Ent. Ges.] 7: 1-2, ill. **Sherman & Perry.**—Insect and plant associations in the Chilcotin. [Rept. Prov. Mus. Nat. Hist. Brit. Col.] 1935: 30-34, ill. **Strong, L. A.**—Stabilizing entomology. [12] 29: 1-6. **Swezey, O. H.**—The insect fauna of Ieie (Freycinetia arborea) in Hawaii. [37] 9: 191-202. **Vaz, Z.**—Ectoparasitas de animaes domesticos observados no Estado de S. Paulo. [14] 6: 29-33. **Wardle, R. A.**—General Entomology. P. Blakiston's Son & Co., Philadelphia. 311 pp., ill. **Warnecke, G.**—Microclimat et distribution des Papillons. [L'Amat. Papillons] 8: 35-44, ill. **Weiss, H. B.**—The Pioneer Century of American Entomology. New Brunswick, N. J. 1936 320 pp. **Wilder, Gerrit Parmele.**—Obituary by Swezey & Ehrhorn. [37] 9: 189-190.

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ORTHOPTERA.—Hebard, M.—Orthoptera of North Dakota. [N. D. Agr. Coll. Exp. Sta.] Bull. (Tech.) 284: 69 pp. **Salfi, M.**—Grillidi della Guiana inglese raccolti dalla spedizione Beccari (1931-32). [Ann. Mus. Zool. R. Univ. Napoli] 6: no. 17, 7 pp., ill. (*). **de Toleda Piza, S.**—Um novo Phasmida do Brasil. [105] 6: 98-100, ill.

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LEPIDOPTERA.—Austen & Hughes.—Clothes moths and house moths. [Br. Mus.) Econ. Ser. 14: 50 pp., ill. **Carpenter, G. D. H.**—Birds do attack butterflies. [Sci. Progress, London] 30: 628-634. **Clark, B. P.**—Descriptions of twenty-four new Sphingidae and notes concerning two others. [Proc. N. Engl. Zool. Cl.] 15: 71-91. **Comstock & Dammers.**—Metamorphosis of Strymon lida. [38] 35: 6-8, ill. **Davenport, D.**—A new American Coenonympha (Satyr.). [4] 68: 79. **Hambleton & Forbes.**—Uma lista de lepidoptera (Heterocera) do Estado de Minas Geraes. [14] 6: 213-236. **Kieffer, H. H.**—California Microlepidoptera VIII. [38] 35: 9-29, ill. (*). **McDunnough, J.**—On the identity and type locality of Euphydryas editha. [38] 35: 1-2. **Rudkin, C. N.**—Interrelationships of Anthocharis cithura and A. pima (Pier.). [38] 35: 3-5, ill. **de Toleda Piza, S.**—Uma nova especie de Pieridae pertencente a um genero ainda nao assignalado no Brasil. [105] 6: 117-120, ill.

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SPECIAL NOTICES.—Stiles, C. W.—Notice of possible suspension of rules of nomenclature in certain cases. [68] 83: 552-553. (Orthop., Lepid., Hymen., etc.)

THE PIONEER CENTURY OF AMERICAN ENTOMOLOGY. By HARRY B. WEISS. Published by the Author, New Brunswick, New Jersey, 1936. 320 mimeographed pages 27.7 x 20.8 cm. $4.25 postpaid.—The author, who is well known as the Chief of the Bureau of Plant Industry of the New Jersey State Department of Agriculture, and as the editor of the *Journal of the New York Entomological Society*, and who has contributed many readable historical and biographical articles on entomologists to the *Scientific Monthly* and other magazines, starts his book and his preface as follows: "At the outset I may as well confess that the title of this book is not strictly indicative of its contents. I have attempted to cover a longer period than a century, and to trace the record of entomology from its beginnings in this country to the year 1865."

Mr. Weiss's treatment of his material is chronological. He usually begins with the publication of some noteworthy article or book, but a biographical sketch of its author varies the catalogue. Such a sequence sometimes brings together two entomologists whose connection with each other is not obvious, as when Dr. Hans Herman Behr's exhibition, in 1855, at San Francisco, of insects of Honolulu, is followed by the account of the first paper, in 1856, in the *Proceedings* of the Philadelphia Academy, by the young entomologist of Baltimore, Philip Reese Uhler, or when the Honorable J., and the plain Thomas, Barlow, "disporting" themselves in the *American Quarterly Journal of Agriculture and Science* on the study of entomology and its novel productions, respectively, in 1845 and 1846, immediately precede the description of Dr. W. S. W. Ruschenberger's *Elements of Entomology* of 1845.

The grouping of data as evidenced by the titles of the chapters is: I. Entomology in the Accounts of Early Travelers (1588-1723), II. The Entomology of Early Books and Papers (1731-1800), III. The Early years of the Nineteenth Century (1800-1817), IV. Thomas Say and his Contemporaries (1817-1831), V. From Zimmermann to LeConte (1832-1845), VI.

Asa Fitch and Other Entomologists (1845-1854), VII. The Glover and Osten Sacken Period (1855-1860), VIII. From Walsh to Cowan (1860-1865), IX. The Entomology in Agricultural Periodicals before 1865, X. Scientific Societies, Scientific Journals, and Exploring Expeditions Contributing to the Progress of American Entomology, XI. Some Notes on Canada, XII. Entomology in Europe During the Pioneer Century in America.

The great names of American entomology previous to 1865 are commemorated, each in two or more pages. Of them Mr. Weiss justly remarks, p. 172, "One of the disadvantages of writing about outstanding entomologists in a work like this, is that such men having contributed so enormously to the science and having written so extensively—really, in order to have justice done them should be considered by themselves in separate volumes. It is easy to be specific and detailed about the work of an author of one or two short papers. It is difficult when the author has written a hundred lengthy articles, reports, etc., involving hundreds of species, observations, etc. And so it is necessary to be general about the work of Dr. Fitch and to refer those who want more information to the bibliography of Dr. Fitch's entomological writings which J. A. Lintner published in . . . 1882." Mr. Weiss has heeded his own prescription with his excellent biography of Thomas Say (1931), written in conjunction with Miss Grace Ziegler, reviewed in the NEWS for March, 1931, pp. 90-93. The passage quoted above recalls some expressions in the preface to Bodenheimer's two volumes on the history of entomology (1928) and, like him, Mr. Weiss would doubtless consider his own work as materials for a history, not a history itself.

That the lesser entomologists are not forgotten may be seen from an examination of the index, in which are entered the names of about 400 individuals of the period who have some claim to this title. Mr. Weiss has brought together a great mass of information concerning them and all their present confreres will do well to obtain this book at once, for only 150 copies have been published, owing to the author's inability to find a publisher willing to put the volume into print. Mr. Weiss can be reached at 19 North Seventh Avenue, Highland Park, New Jersey.—PHILIP P. CALVERT.

ZUR KENNTNISS DER ODONATENPARASITEN, mit ganz besonderer Rücksichtigung der Ökologie der in Europa an Libellen schmarotzenden Wassermilben. Von PAUL MÜNCHBERG. Archiv f. Hydrobiologie, Bd. XXIX S. 1-120. Published Nov. 1, 1935.—Although this work treats of European parasites of European Odonata, it contains much that is of interest to stu-

dents in other parts of the world. The first section reviews the literature on egg-parasitic Hymenoptera, from which it appears that the identifications of those species supposed to have issued from Odonate eggs are in great confusion. As the title states, the greatest part of this work deals with Hydrachnine larvae. They have been reported from 12 species of Zygoptera and 15 species of Anisoptera. The author has reared nymphs from larvae attached to 17 species of Zygoptera and 11 species of Anisoptera of Europe; they belong to the genera *Arrhenurus* Duges and *Georgella* Koenike. Twenty-four species of *Arrhenurus* and one of *Georgella* from Odonate hosts have been distinguished. Thrombidiid and Erythraeid larvae occur much less frequently on the Odonata and are considered as errant parasites. Odonata with rheophilous nymphs, especially Calopterygidae and Gomphidae, transform mite-free, as mites of the genera named are typical pond dwellers and avoid flowing water. The larvae of *Arrhenurus papillator* were found on 8 species of *Sympetrum* and 4 species of *Lestes, A. pustulator* larvae on one species each of seven genera of Anisoptera and one species of *Agrion*. The same species of larval mite attaches itself to different parts of different hosts. Thus *A. papillator* fastens itself to the lower surface of the basal wing-veins of *Sympetrum meridionale* and *fonscolombei*, but to the thorax or to the abdominal sternites of the other hosts. The parasitic phase lasts in general 3-4 weeks, but those which attach themselves to the wing-veins require a longer period, 6-8 weeks, perhaps due to the slighter amount of nourishment afforded by the veins. Details of the periods occupied by the nymphal stages, based on numerous rearings in laboratories are given. Two modes of infection of Odonate imagos by larvae of water mites are designated as prenatal and postnatal, *i. e.* before or after transformation. Swimming larvae, *i. e.* those of *Arrhenurus*, chiefly infect the Zygoptera prenatally, although postnatal infection may also occur when dragonflies of this suborder descend below the water's surface for endophytic oviposition. Infection of Anisoptera in general and by *Arrhenurus papillator* of *Lestes* occurs prenatally ("nur bei der Geburt" *cf.* pp. 80-81 and 110). While the author had no opportunity to rear larvae of *Georgella*, he believes that they infect their Zygopterous hosts postnatally (pp. 77, 83). Dr. Münchberg is known as the author of excellent papers on the life histories of German Odonata and the morphology of their larvae (1930-1933). Those studies led him to the investigation of their Hydrachnine parasites and his numerous observations and experiments on their development and ecology furnish the present important contribution.—PHILIP P. CALVERT.

EXCHANGES

This column is intended only for wants and exchanges, not for advertisements of goods for sale or services rendered. Notices not exceeding three lines free to subscribers.

These notices are continued as long as our limited space will allow; the new ones are added at the end of the column, and, only when necessary those at the top (being longest in) are discontinued.

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Wanted—Dr. Karl Eller of the Zoological Institute, of the University of Munich, who is at present engaged in a critical study of the races of **Papilio machaon** and related species, particularly desires to secure for study, as loans or otherwise, material of the American representatives of this group. To be of service to him material must bear exact localities, altitudes when possible, and dates of capture. Dr. Eller has largely completed his work in the Old World forms and requests the cooperation of American students so that his investigations may be of broadly comprehensive character.

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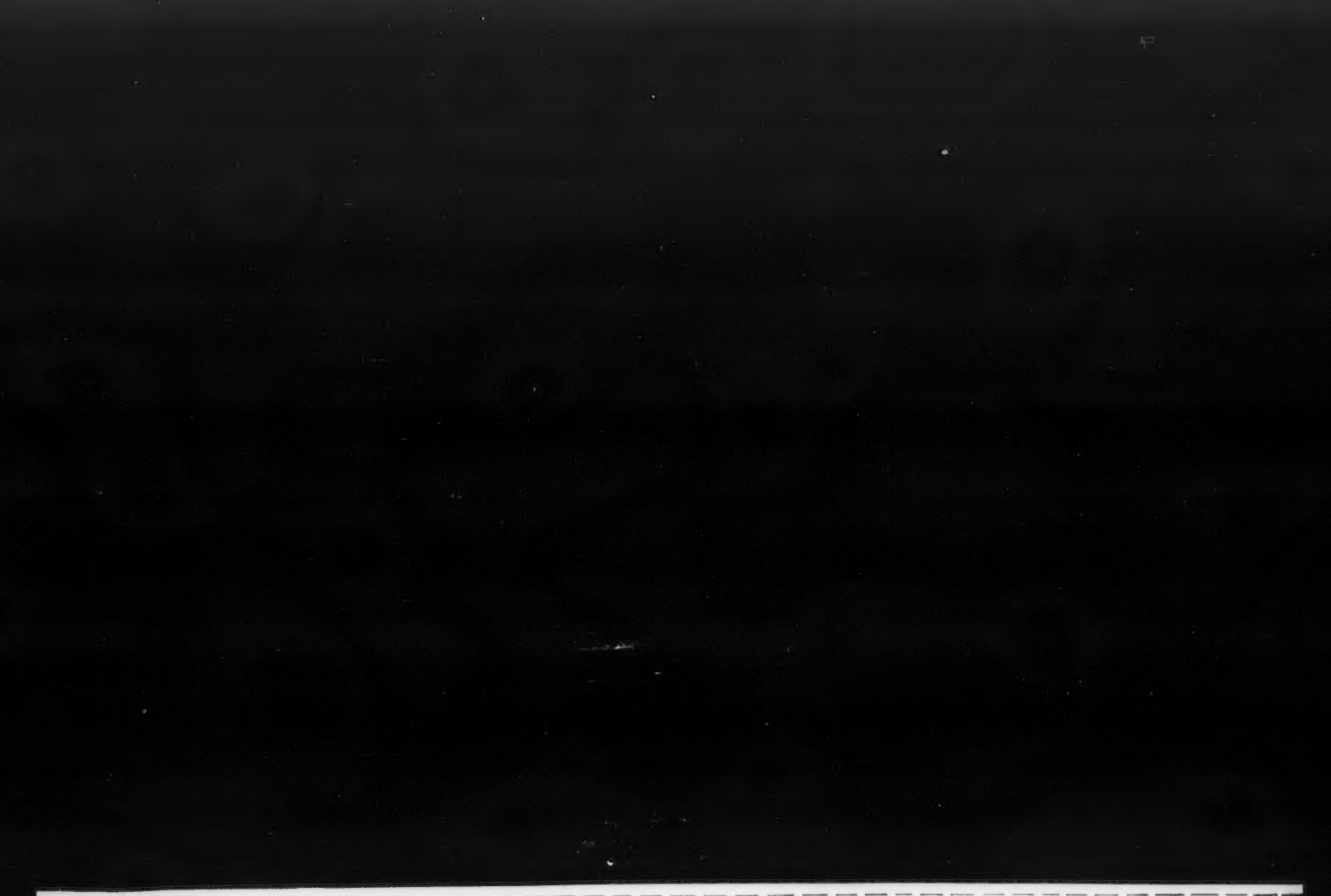

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